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Circle West Vegetation Monitoring Study

Second Annual Report

for the period
August 14 - 24, 1979

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Circle West Technical Report No. 5

Facility Siting Division
Montana Department of Natural
Resources and Conservation
32 South Ewing
Helena, Montana 59601

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INTRODUCTION

The Circle West vegetation monitoring program began in 1978 at the request of Dreyer Brothers, Inc., to provide long-term monitoring of the productivity of certain vegetation types in McCone County, Montana. This study is essentially a continuation of the Circle West Baseline Vegetation Study and 1978 Monitoring Study (Prodgers 1978, DNRC 1979).

METHODS

Aerial Production

Twelve permanently fenced exclosures (figure 1) were sampled during this study. (Note: exclosure No. 9, Juho/Ansc-Agsp, is shown in figure 1 but was not sampled in 1979). The 1979 productivity sampling procedures were the same as those used in the 1977 and 1978. Sampling took place from August 14, 1979 through August 24, 1979. The number of productivity samples taken per exclosure was determined using 1977 and 1978 data.

Frequency and Coverage

Within each exclosure, twenty 20 cm x 50 cm plots were sampled for plant coverage using the technique described by Daubenmire (1959). Coverage was estimated as accurately as possible; cover classes were not used. Plots were located along topographic contours in series of ten. The same plots were sampled in 1978. None of these plots have been clipped. Color transparencies of each plot were taken at the time of sampling.

RESULTS

Aerial Production

By early spring, the soil moisture regime in the exclosures appeared to be good due to the rather moist winter (11.9 cm of precipitation at Circle, Montana from Nov. 1, 1978 through March 31, 1979) and residual soil moisture from the exceedingly moist summer of 1978. In 1979, May-June precipitation was 8.1 cm (3.2 inches) and April-July precipitation was 14.9 cm (5.8 inches). The exclosure areas appeared to receive somewhat less precipitation, particularly in July. Grasshopper levels were generally moderate.

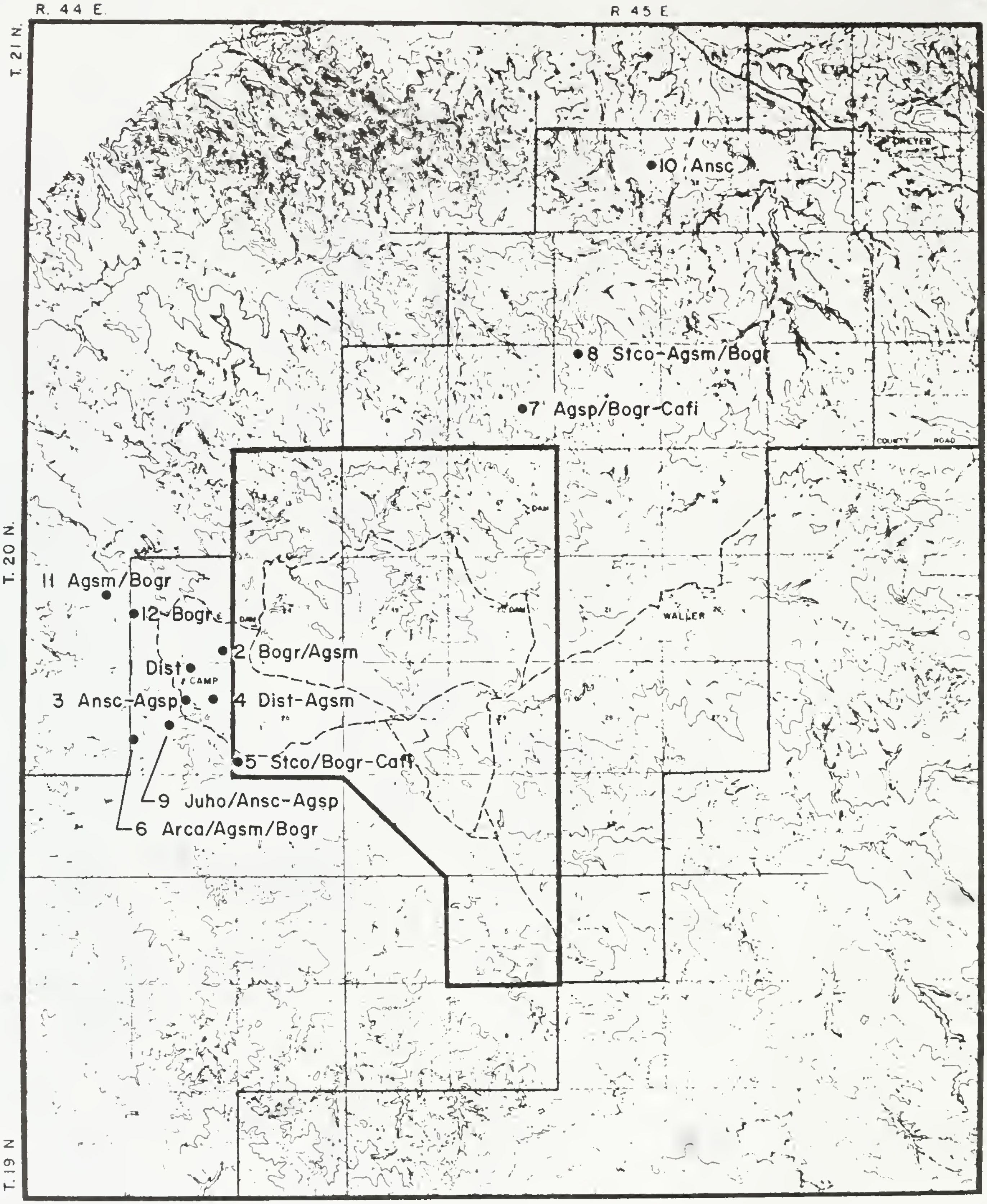

FIGURE I. LOCATION OF CIRCLE WEST VEGETATION EXCLOSURES

(NOTE: Exclosure 13, Bogr-Cafi/Stco, is located off the map in the southwest corner, Sec. 8, T. 20 N. R. 46 E.)

As productivity data for the exclosure accumulate , a graphic approach to data summarization may be more suitable than a statistical one. Figures 2 through 5 portray production in 1977-1979.

Tables 1 through 12 describe productivity of the exclosure as sampled in 1979. These tables are presented in the same format as earlier reports (Prodgers 1978, 1979) to facilitate comparisons. Means and standard deviations are expressed in kilograms per hectare (for pounds per acre multiply by 0.892). N is the number of plots theoretically necessary to obtain a sample within 20 percent of the true mean ninety percent of the time. This represents a deviation from prior years when N was calculated on the basis of an 80 percent probability level. This requirement proved to be too lax. Further refinements may be necessary in the years to come.

In 1979, only the Ansc-Agsp and Ansc exclosures proved to be nonhomogenous at the .05 probability level, compared to five exclosures in 1978. This supports the contention (Prodgers 1979) that the high precipitation of 1978 resulted in increased heterogeneity within exclosures.

Figure 2. Production in Stco/Bogr-Cafi, Bogr-Cafi/Stco, and Stco-Agsm/Bogr Exclosures

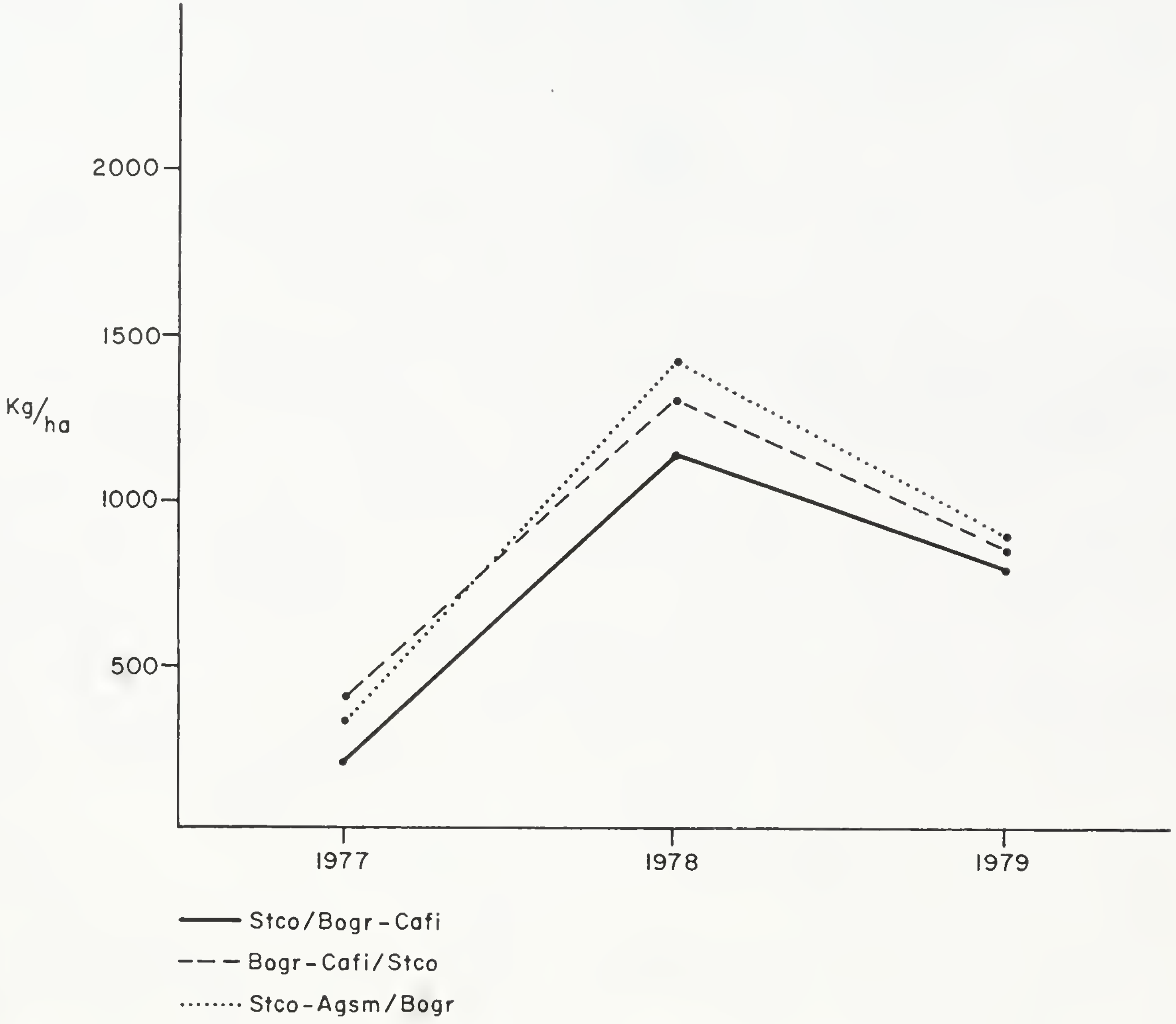

Figure 3. Production in Bogr, Bogr/Agsm, and Agsm/Bogr Exclosures

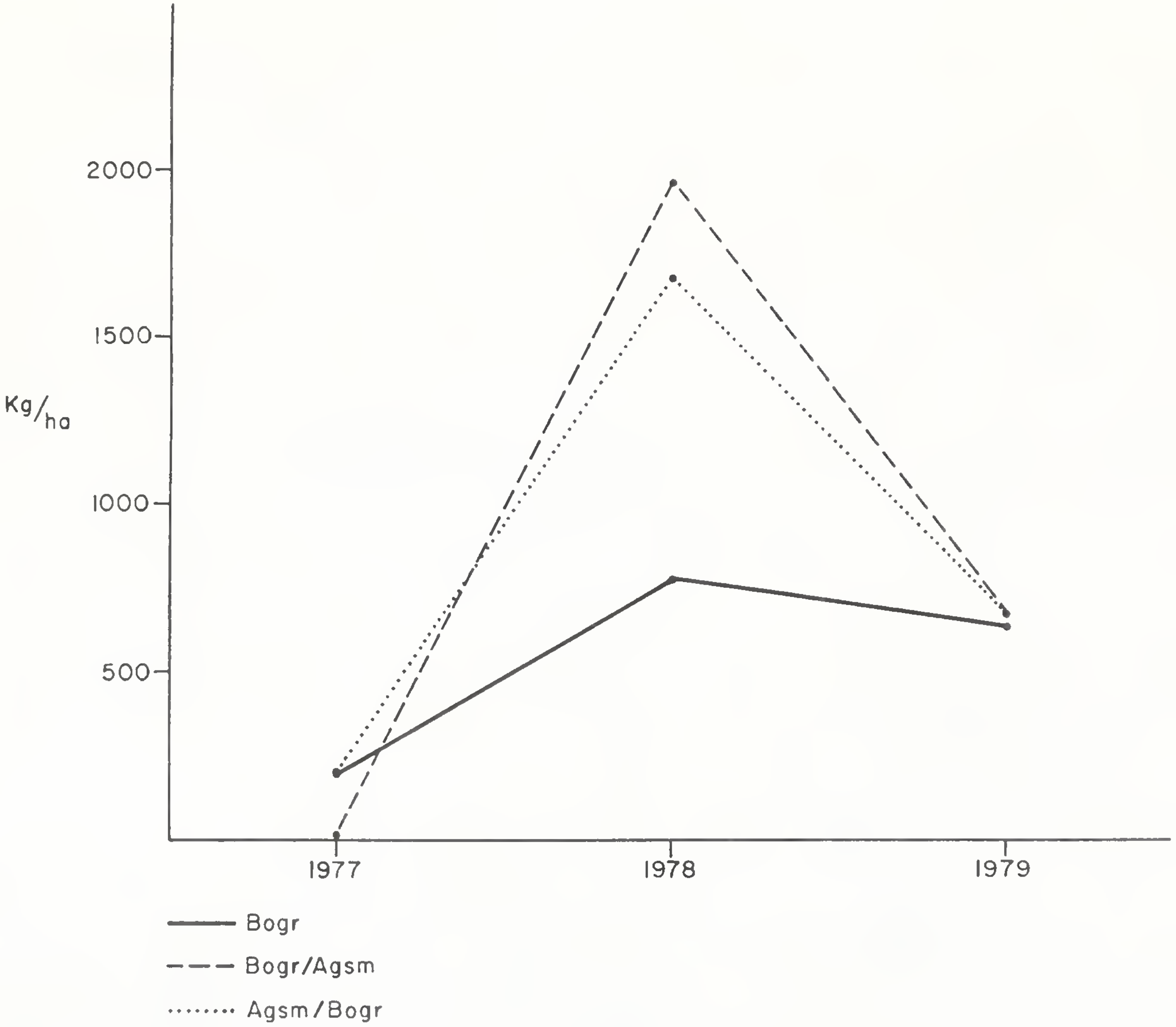

Figure 4. Production in Ansc, Ansc-Agsp, and Agsp/Bogr-Cafi Exclosures

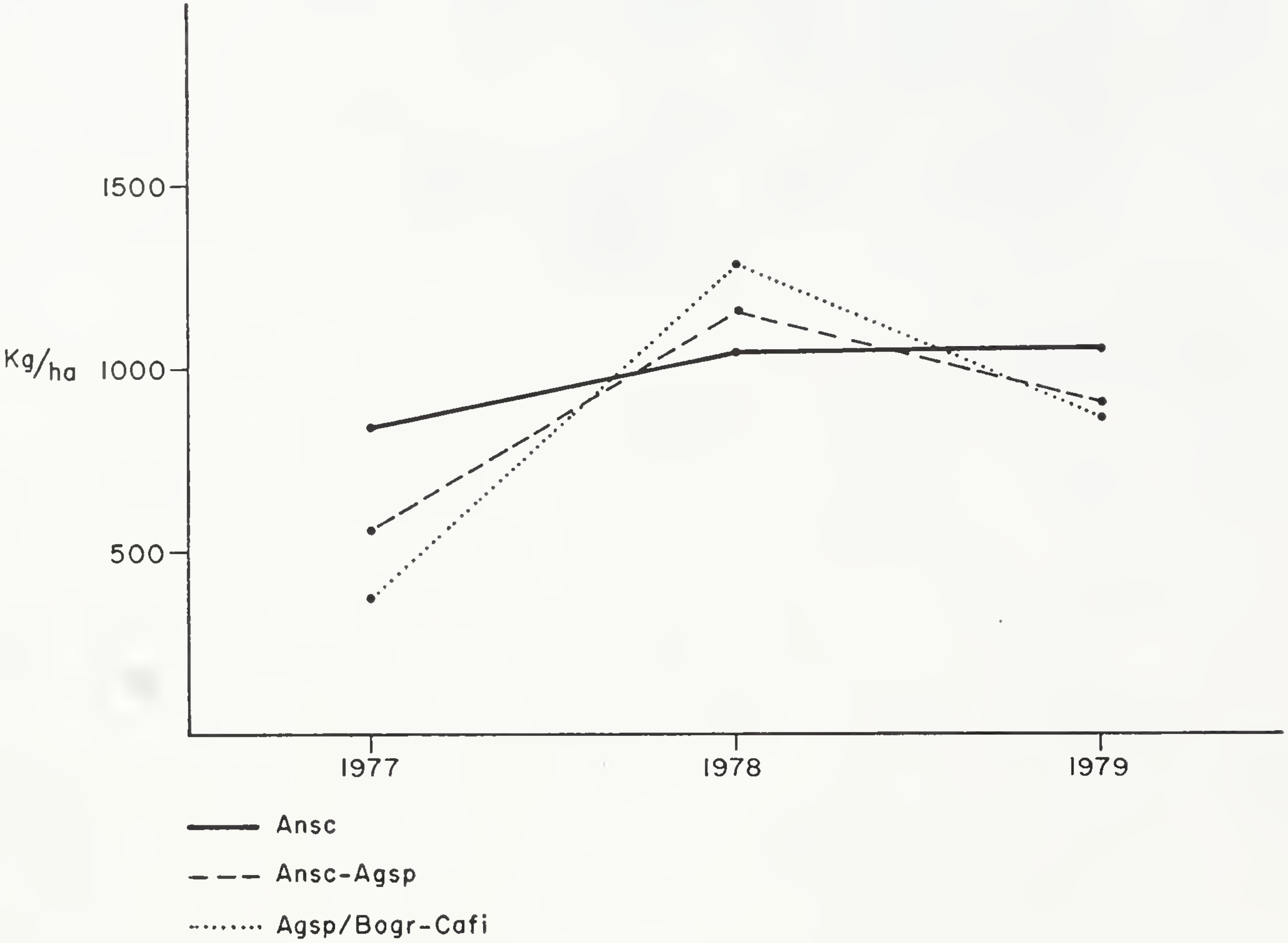

Figure 5. Production in Dist, Dist-Agsm, and Arca/Agsm/Bogr Exclosures

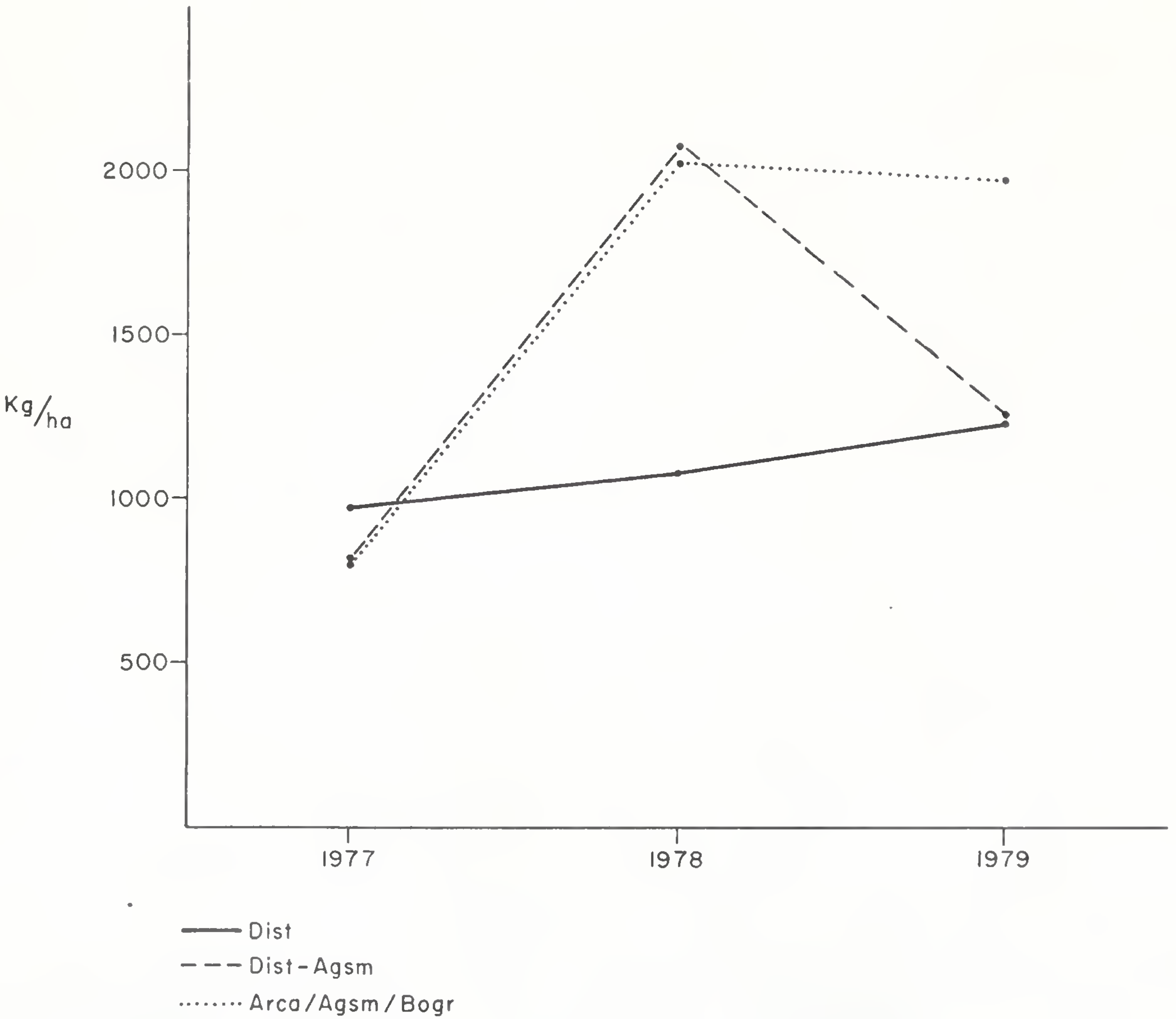

Table 1. *Distichlis stricta* c.t. (n = 8)

	Dist	Litter	Σ Productivity
$\bar{X}$	1226	348	1230
S	210	220	204
CV	.17	.63	.17
N	2		2

Table 2. *Distichlis stricta* - *Agropyron smithii* ecotane (n = 10)

	Dist	Agsm	Hemi	Litter	Σ Productivity
$\bar{X}$	856	252	164	1432	1248
S	300	130		396	364
CV	.35	.52		.28	.29
N	9	18			6

Table 3. *Boutelova gracilis* c.t. (n = 14)

	Bogr	Litter	Σ Productivity
$\bar{X}$	606	458	632
S	226	406	232
CV	.37	.89	.37
N	10		9

Table 4. *Agropyron smithii*/*Boutelova gracilis* c.t. (n = 15)

	Agsm	Bogr	Litter	Σ Productivity
$\bar{X}$	464	130	994	674
S	166	56	418	164
CV	.36	.44	.42	.24
N	9	13		4

Table 5. *Boutelova gracilis*/*Agropyron smithii* c.t. (n = 25)

	Bogr	Agsm	Litter	Σ Productivity
$\bar{X}$	134	528	1460	674
S	74	188	592	198
CV	.56	.35	.41	.29
N	21	9		6

Table 6. *Stipa comata*/*Boutelova gracilis* - *Carex Filifolia* c.t. (n = 10)

	Stco	Bogr	Cafi	Geo	Litter	Σ Productivity
$\bar{X}$	312	54	24	234	536	798
S	126	19		110	236	120
CV	.40	.35		.47	.44	.15
N	11	10				2

Table 7. *Boutelova gracilis* - *Carex Filifolial Stipa comata* c.t. (n = 10)

	Bogr	Cafi	Stco	Geo	Litter	Σ Productivity
X	228	170	334	44	558	840
S	158	146	184		280	200
CV	.69	.86	.55		.50	.24
N	32	50	21			4

Table 8. *Stipa comata* - *Agropyron smithii*/*Boutelova gracilis* c.t. (n = 10)

	Stco	Agsm	Bogr	Hemi*	Litter	Σ Productivity
$\overline{X}$	194	370	140	118	914	886
S	126	234	66	74	570	230
CV	.65	.63	.47	.62	.62	.26
N	30	27	15			5

* Mostly *Carox Filifolia*.

Table 9. *Andropogon scoparius* c.t. (n = 12)

	Ansc	Hemi	Geo	Litter	Σ Productivity
$\overline{X}$	954	120	156	734	1056
S	456	56		468	588
CV	.48	.47		.64	.56
N	16	15			21

Table 10. Andropogon Scoparius - Agropyron spicatum c.t. (n - 10)

	Ansc	Agsp	Hemi	Cham	Litter	Σ Productivity
$\overline{X}$	104	268	394	62	774	902
S	176	152	176		334	246
CV	1.7	.56	.45		.43	.27
N	208	21				5

Table 11. Agropyron spicatum/Boutelova gracilis - Carex Filifolia (n = 14)

	Agsp	Bogr	Cafi	Hemi	Cham	Litter	Σ Productivity
$\overline{X}$	596	48	52	86	96	520	866
S	210	40	24	80	70	164	280
CV	.35	.85	.48	.94	.73	.31	.32
N	9	47	15				5

Table 12. Artemisia cana/Agropyron smithii/Boutelova gracilis c.t. (n = 14)

	Arca	Agsm	Bogr	Hemi	Litter	Σ Productivity
$\overline{X}$	698	656	418	138	1752	1970
S	744	260	228		1344	672
CV	1.1	.40	.54		.77	.34
N	76	11	20			8

Perhaps the most striking feature found in comparing the 1979 data with earlier data is the increase in litter, particularly in exclosures with a significant amount of *Agropyron smithii*. Table 13 summarizes this increase.

Most of the dramatic increases in litter are linked to *Agropyron smithii*. This species has now changed the composition of the Bogr/Agsm and Stco/Bogr exclosures. Litter accumulation may also become a problem. It is suggested that some exclosures be opened to grazing following clipping in 1980. (This topic is further discussed later in this report.)

Frequency and Coverage

Plant coverage was generally down and the amount of bare ground higher than in 1978. Annuals in particular showed a marked decline, probably as a result of the drier conditions experienced in 1979 (Table 14).

Some other changes are worth noting. *Agropyron smithii* was virtually absent from the Stco/Bogr-Cafi exclosures in 1978 and increased to an average 10% coverage in 1979. Litter also increased significantly. In the Bogr/Agsm exclosure, *Agropyron smithii* coverage diminished while coverage of litter and bare ground increased substantially. Litter increased greatly in the Agsm/Bogr exclosure also. Plant coverage was greatly reduced in the Dist-Agsm exclosure.

The Bogr exclosure is apparently the site of a one-time prairie dog town. Patches of *Agropyron smithii* are found in this exclosure; the distribution appears to be contagious. These patches appear to be expanding under exclosure conditions.

It is suggested that the Bogr, Dist-Agsm. Stco/Bogr-Cafi, and Bogr/Agsm exclosures be left open during 1980 following clipping to allow grazing. These exclosures should then be monitored to prevent any severe damage and closed prior to any grazing in 1981.

Table 13.

Exclosure	Kilograms of Litter per Hectare in 1977	1978	1979
Dist	430	416	348
Dist-Agsm	1071	521	1432
Bogr	38	375	458
Agsm/Bogr	578	363	994
Bogr/Agsm	38	280	1460
Stco/Bogr-Cafi	162	120	536
Bogr-Cafi/Stco	247	267	558
Stco-Agsm/Bogr	417	356	914
Ansc	1084	660	734
Ansc-Agsp	787	438	774
Agsp/Bogr-Cafi	727	306	520
Arca/Agsm/Bogr	753	633	1752

Table 14.
Species Composition of Exclosures:
Average Coverage and Frequency (n = 20)

	Arca/ Agsm/ Bogr	Stco/ Bogr- Cafi	Bogr- Cafi/ Stco	Ansc- Agsp	Bogr/ Agsm	Agsm/ Bogr	Agsp/ Bogr- Cafi	Dist/ Agsm	Bogr	Stco- Agsm/ Bogr	Dist	Ansc
Achillea millifolium	0.6(10)[1/]	-	-	-	-	-	-	-	-	-	-	-
Agropyron smithii	22.0(95)	10.0(100)	-	-	23.5(100)	37.5(100)	-	11.8(85)	21.2(100)	2.0(15)	-	-
Agropyron spicatum	-	-	-	8.8(55)	-	-	34.3(100)	-	-	-	-	0.5(10)
Andropogon scoparius	-	-	-	13.1(55)	-	-	-	0.5(5)	-	-	-	60.2(100)
Antennaria sp.	-	-	-	-	-	-	-	-	-	-	-	-
Aristida longiseta	-	-	-	7.8(30)	-	-	-	-	-	-	-	-
Artemisia cana	37.2(80)	-	-	-	-	-	-	-	-	-	-	-
Artemisia frigida	1.6(25)	-	-	1.5(20)	-	-	-	-	1.5(10)	-	-	-
Astragalus pectinatus	-	-	-	-	-	-	-	-	-	-	-	0.8(10)
Bouteloua gracilis	21.7(75)	10.7(100)	29.8(100)	0.5(5)	41.3(100)	36.7(100)	12.1(80)	-	12.7(95)	81.0(100)	-	-
Calamagrostis montanensis	-	-	-	-	-	-	-	-	1.3(25)	-	-	-
Calamovilfa longifolia	-	-	-	-	-	-	-	4.0(25)	-	-	-	-
Carex filifolia	-	-	12.5(100)	12.4(70)	-	2.1(60)	6.1(95)	1.0(10)	13.6(80)	-	-	1.6(15)
Carex pensylvanica	-	-	-	-	-	-	-	-	-	-	-	0.5(20)

Table 14 (Continued)

						Exclosure						
	Arca Agsm/ Bogr	Stco/ Bogr- Cafi	Bogr- Cafi/ Stco	Ansc- Agsp	Bogr/ Agsm	Agsm/ Bogr	Agsp/ Bogr- Cafi	Dist/ Agsm	Bogr	Stco- Agsm/ Bogr	Dist	Ansc
Chrysopsis villosa	-	-	-	1.8(5)	-	-	-	-	-	-	-	-
Cirsium undulatum	-	-	-	0.7(5)	-	-	-	-	-	-	-	-
Distichlis stricta	-	-	-	-	-	-	-	29.8(100)	-	-	43.3(100)	-
Echinacea pallida	-	-	-	0.5(5)	-	-	-	-	-	-	-	2.9(70)
Eurotia lanata	-	-	-	-	-	-	3.0(45)	-	0.9(10)	-	-	-
Festuca octoflora	-	-	0.5(10)	-	-	-	-	-	-	-	-	-
Gaura coccinea	-	-	2.0(30)	2.1(25)	-	-	-	-	-	-	-	-
Guttierrezia sarothrae	-	-	-	3.5(15)	-	-	4.3(55)	-	-	-	-	-
Koeleria cristata	-	-	-	1.4(25)	-	-	1.3(15)	0.8(25)	4.0(35)	-	-	0.7(20)
Linum rigidum	0.6(15)	-	-	-	-	-	-	-	-	-	-	-
Lygodesmia juncea	-	1.7(30)	-	-	-	-	-	-	1.5(15)	-	-	-
Muhlenbergia cuspidata	-	-	-	9.4(60)	-	-	-	-	-	-	-	3.8(30)

Table 14 (Continued)

	Arca/ Agsm/ Bogr	Stco/ Bogr- Cafi	Bogr- Cafi/ Stco	Ansc- Agsp	Bogr/ Agsm	Agsm/ Bogr	Agsp/ Bogr- Cafi	Dist/ Agsm	Bogr	Stco- Agsm/ Bogr	Oist	Ansc
Petalostemon sp.	-	-	-	0.5(10)	-	-	-	-	-	-	-	-
Phlox hoodii	-	-	1.7(30)	-	-	-	5.4(85)	1.2(15)	1.2(10)	-	-	0.6(15)
Plantago patagonica	-	2.0(100)	3.1(100)	-	-	-	-	1.3(50)	0.8(80)	-	-	-
Plantago spinulosa	0.8(25)	-	-	-	-	-	-	-	-	-	-	-
Poa sandbergii	-	-	-	-	-	-	-	-	0.7(15)	5.2(75)	-	-
Poa sp.	-	-	-	-	-	-	-	0.8(20)	-	-	-	-
Polygala alba	-	-	-	5.1(35)	-	-	-	-	-	-	-	-
Solidago missouriensis	-	-	-	-	-	-	-	-	-	-	-	3.2(30)
Sphaeralcea coccinea	-	-	-	-	-	-	-	-	-	-	-	-
Stipa comata	0.8(5)	48.0(100)	37.8(100)	5.2(35)	-	-	8.0(60)	2.0(20)	16.0(80)	-	-	-
Stipa viridula	2.5(10)	-	-	2.0(15)	-	-	-	-	-	-	-	-
Suaeda depressa	-	-	-	-	-	-	-	-	-	-	1.1(15)	-
Bare ground	1.1(30)	26.3(100)	9.5(100)	14.8(100)	28(100)	6.5(90)	20.1(100)	4.6(65)	13.2(100)	5.7(100)	32.2(100)	26.1(100)
Rock	-	-	-	19.7(100)	-	-	-	-	-	-	-	-
Litter	65.5(100)	23.8(100)	21.8(100)	21.8(100)	34.5(100)	45.3(100)	32.5(100)	62.0(100)	35.7(100)	22.8(100)	26.3(100)	41.3(100)

1/ Coverage (Frequency)

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